

I Claim:

1. A stream shaper having a pair of axially-spaced vane groups, each vane group having a plurality of circumferentially-spaced axially extending vanes,
5 and said vanes in one of said vane groups being circumferentially offset relative to said vanes in the other of said vane groups.

2. The stream shaper of claim 1 including inner and outer cylindrical walls, said vanes extending radially between said inner and outer cylindrical walls.

10

3. The stream shaper of claim 2 wherein said inner cylindrical wall has an axially extending cylindrical passage therethrough.

15

4. The stream shaper of claim 1 wherein each said vane group has an equal number of vanes and said vanes in each vane group are circumferentially-spaced equidistantly, said vanes in one vane group being centered between said vanes in the other of said vane groups.

20

5. The stream shaper of claim 1 wherein each vane group has eight vanes.

6. The stream shaper of claim 1 wherein said vane groups are axially-spaced a distance that provides reassembly of liquid streams flowing through one of said vane groups into a single liquid stream prior to flowing through the other of said vane groups.

25

7. The stream shaper of claim 1 wherein said stream shaper is of one-piece construction.

30

8. The stream shaper of claim 1 wherein said vanes have a smooth finish.

9. The stream shaper of claim 1 wherein one of said vane groups is an exit vane group, and said vanes in said exit vane group having tapered discharge ends.

10. The stream shaper of claim 9 wherein said tapered discharge ends are 5 rounded.

11. The stream shaper of claim 1 wherein said vane groups are of equal axial length.

10 12. The stream shaper of claim 1 wherein said vanes have an outer diameter and said vane groups have an inner cylindrical wall with an axially extending cylindrical passage therethrough, and said cylindrical passage having a diameter that is not greater than one-third of said outer diameter.

15 13. The stream shaper of claim 1 wherein said vane groups are spaced-apart between 0.150-0.350 inches.

14. The stream shaper of claim 1 wherein said vane groups have vane 20 passages between adjacent vanes, said stream shaper having an inner central cylindrical passage, and said central cylindrical passage having a cross-sectional area that is within twenty percent of the cross-sectional area of each of said vane passages.

25 15. A stream shaper having axially-spaced groups of flow passages, each group of passages including a plurality of circumferentially-spaced individual flow passages, said flow passages in one of said groups of flow passages being circumferentially offset relative to said flow passages in the other of said groups of flow passages so that fluid flowing through an individual flow passage in one of said groups of flow passages flows through a plurality of individual flow passages in the other of said groups of flow passages.

16. The stream shaper of claim 15 wherein said axially-spaced groups of flow passages include axially aligned central flow passages.

17. The stream shaper of claim 15 wherein said axially-spaced groups of flow passages are spaced-apart such that fluid flowing through said flow passages in 5 one of said groups of flow passages reassembles into a single stream prior to flowing through said flow passages in the other of said groups of flow passages.

18. The stream shaper of claim 15 wherein said individual flow passages in said axially-spaced groups of flow passages are formed by a plurality of axially-10 extending circumferentially-spaced vanes that extend radially of the stream shaper axis.

19. The stream shaper of claim 15 wherein said axially-spaced groups of flow passages have approximately the same axial length and the same number of flow 15 passages.

20. The stream shaper of claim 15 wherein said flow passages include centrally located aligned flow passages in said axially-spaced groups of flow passages, the remainder of said flow passages in said groups of flow passages being 20 circumferentially-spaced around said centrally located aligned flow passages.

21. The stream shaper of claim 20 wherein said groups of flow passages have an outer periphery and said remainder of said flow passages comprise a single ring of flow passages between said centrally located aligned flow passages and said 25 outer periphery.

22. A stream shaper having axially-spaced stream dividers that divide a single stream into a plurality of smaller streams, each stream divider including inner and outer cylindrical walls, a plurality of vanes circumferentially-spaced equidistantly 30 between said inner and outer cylindrical walls, said inner cylindrical wall having a

flow passage therethrough with a longitudinal axis, said vanes extending radially of and parallel to said axis, and said vanes in one of said stream dividers being circumferentially displaced relative to the vanes in the other of said stream dividers so that the vanes in one stream divider are approximately midway between the vanes in 5 the other stream divider.

23. The stream shaper of claim 22 wherein said stream dividers are axially-spaced a sufficient distance to provide reassembly of the individual streams from one of the stream dividers into a single stream prior to flowing through the other 10 stream divider.

24. A stream shaper having axially-spaced stream dividers that divide a single stream into a plurality of smaller streams, said stream dividers being circumferentially offset relative to one another such that smaller streams formed by 15 one stream divider are circumferentially offset relative to smaller streams formed by the other stream divider.

25. The stream shaper of claim 24 wherein said stream dividers are circumferentially offset such that smaller streams formed by one stream divider are 20 centered between adjacent pairs of smaller streams in the other stream divider.

26. The stream shaper of claim 24 wherein said stream dividers are axially spaced to provide reassembly of the smaller streams from one stream divider into a single stream prior to flowing through the other stream divider.

25

27. The stream shaper of claim 24 wherein each of said stream dividers divide a single cylindrical stream into a smaller central stream and a plurality of circumferentially-spaced smaller outer streams that surround said central stream.

28. A stream shaper having at least two axially aligned stream dividers, each stream divider having a plurality of circumferentially-spaced axial passages, said stream dividers being circumferentially rotated relative to one another to position the passages in one stream divider in overlapping relationship with a plurality of passages in the other stream divider.

5

29. The stream shaper of claim 28 wherein the passages in one stream divider are in overlapping relationship with a pair of passages in the other stream divider.

10

30. The stream shaper of claim 29 wherein each passage in one stream divider overlaps one-half of two adjacent passages in the other stream divider.

31. The stream shaper of claim 28 including a central passage in each stream divider, the remainder of the passages in each stream divider being circumferentially-spaced around said central passage.

15

32. The stream shaper of claim 31 wherein each stream divider has an outer periphery and the remainder of the passages in each stream divider are arranged in a single ring of passages between said central passage and said outer periphery.

20

33. The stream shaper of claim 28 wherein said passages are of approximately equal size.

25

34. The stream shaper of claim 28 wherein each stream divider has the same number of passages.

35. The stream shaper of claim 28 wherein said stream dividers are axially-spaced from one another.

30

36. The stream shaper of claim 35 wherein said stream dividers are axially-spaced a distance that provides reassembly of a plurality of streams flowing through one of said stream dividers into a single stream prior to flowing through the other of said stream dividers.

5

37. A stream shaper having a longitudinal axis, a plurality of vanes that are circumferentially-spaced equidistantly from one another and extend radially of and parallel to said axis, alternate ones of said vanes being axially-paced from the remaining vanes.

10